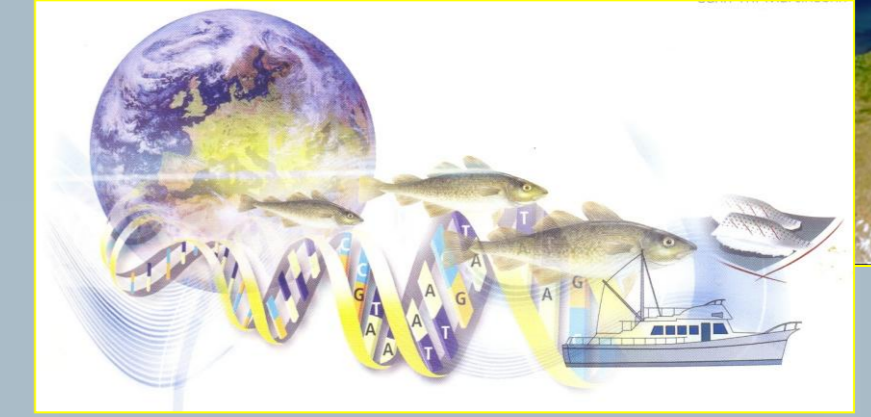


Allozyme variations in turbot populations from north-western part of the Black Sea and Sea of Azov

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Goals: To identify genetically turbot populations along the Bulgarian and Romanian coast;
To analysed the taxonomical position of Azov turbot based on allozyme data.

The precise determination of population-gentical structure is in connection with accurate determination of turbot stocks, its sustainable exploitation and protection of the biodiversity. Molecular-genetic characteristic, evaluation and monitoring of species diversity in the Black Sea is in connection with requirements of Marine Strategy Framework Directive.

Main Results and Discussion

Data for electrophoretic pattern of 19 enzyme loci and 12-16 non-enzymatic loci were used to investigate population structure of turbot along the Bulgarian and Romanian Black Sea coasts (Fig.1), analyzing three types of tissue: muscle, eye and haemoglobin.

General muscle proteins (PROT) - Electrophoretical spectra of Black Sea turbot from Bulgarian and Romanian coasts did not show specific differences, but polymorphism could be used for further analyses of their population structure (Fig.2).



Fig.1. Sampling localities



Fig.2. Electrophoregrams on PROT from turbot (Bulgarian and Rumanian coast), using different tissues: 1-3 - haemoglobins, 4-5- eye (retina) and 6 - muscle, 0 - origin.

Two of four esterases loci (*EST-2** and *EST-3**) were proved as a marker enzyme system for distinguishing of turbot populations (Fig.3, Table1). Two populations (southern and northern) along the Bulgarian coast and one in Romanian coast were found (Table 1).

Table 1. Allelic frequencies of polymorphic esterase loci (*EST-2** and *EST-3**) of turbot, analyzing different tissues.

| Tissues | Haemoglobin | | Muscle | | | | Eyes - retina | | |
|---------------|--------------|--------------|--------------|--------------|--------------|--------------|---------------|--------------|---------|
| | Bulgaria | | Bulgaria | | Romania | | Bulgaria | | Romania |
| | South Region | North Region | South Region | North Region | South Region | North Region | South Region | North Region | |
| <i>EST-2*</i> | 0,60 | 0,47 | 0,45 | 0,61 | 0,50 | 0,50 | 0,55 | ----- | 0,50 |
| <i>a</i> | 0,40 | 0,53 | 0,55 | 0,39 | 0,50 | 0,50 | 0,45 | | 0,50 |
| <i>b</i> | | | | | | | | | |
| <i>EST-3*</i> | 0,37 | 0,59 | 0,50 | 0,61 | 0,50 | 0,50 | 0,55 | 0,47 | 0,55 |
| <i>a</i> | 0,63 | 0,41 | 0,50 | 0,39 | 0,50 | 0,50 | 0,45 | 0,53 | 0,45 |
| <i>b</i> | | | | | | | | | |

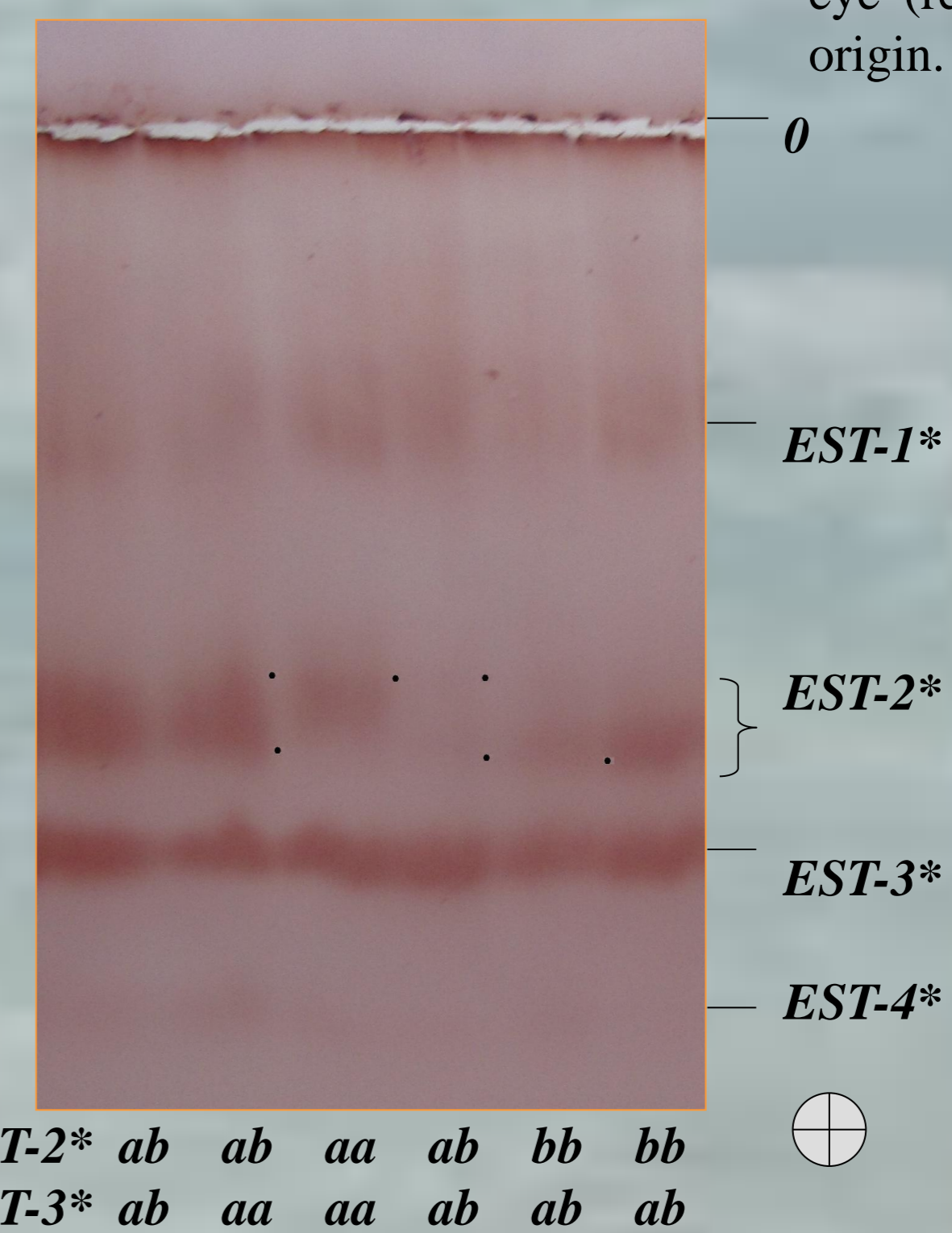


Fig.3. Enzymograms of general unspecified esterases (EST) from muscle tissue of turbot, *EST-1**, *EST-2**, *EST-3** and *EST-4** - polymorphic loci, 0 - origin.

The allele frequencies of *EST-2** and *EST-3** loci of north Bulgarian population were found closely related to the frequencies of Romanian population.

A new potential genetical marker (*LDH-C**) for distinguishing of turbot populations was found (Fig.4). Superoxide dismutase (SOD) showed polymorphism, and could also be used as a marker for identification of turbot population in Black Sea (Fig.5) Other analyzed enzymes as MEP, PGI, 6-PGDH, ADH, FM and PGM are monomorphic.

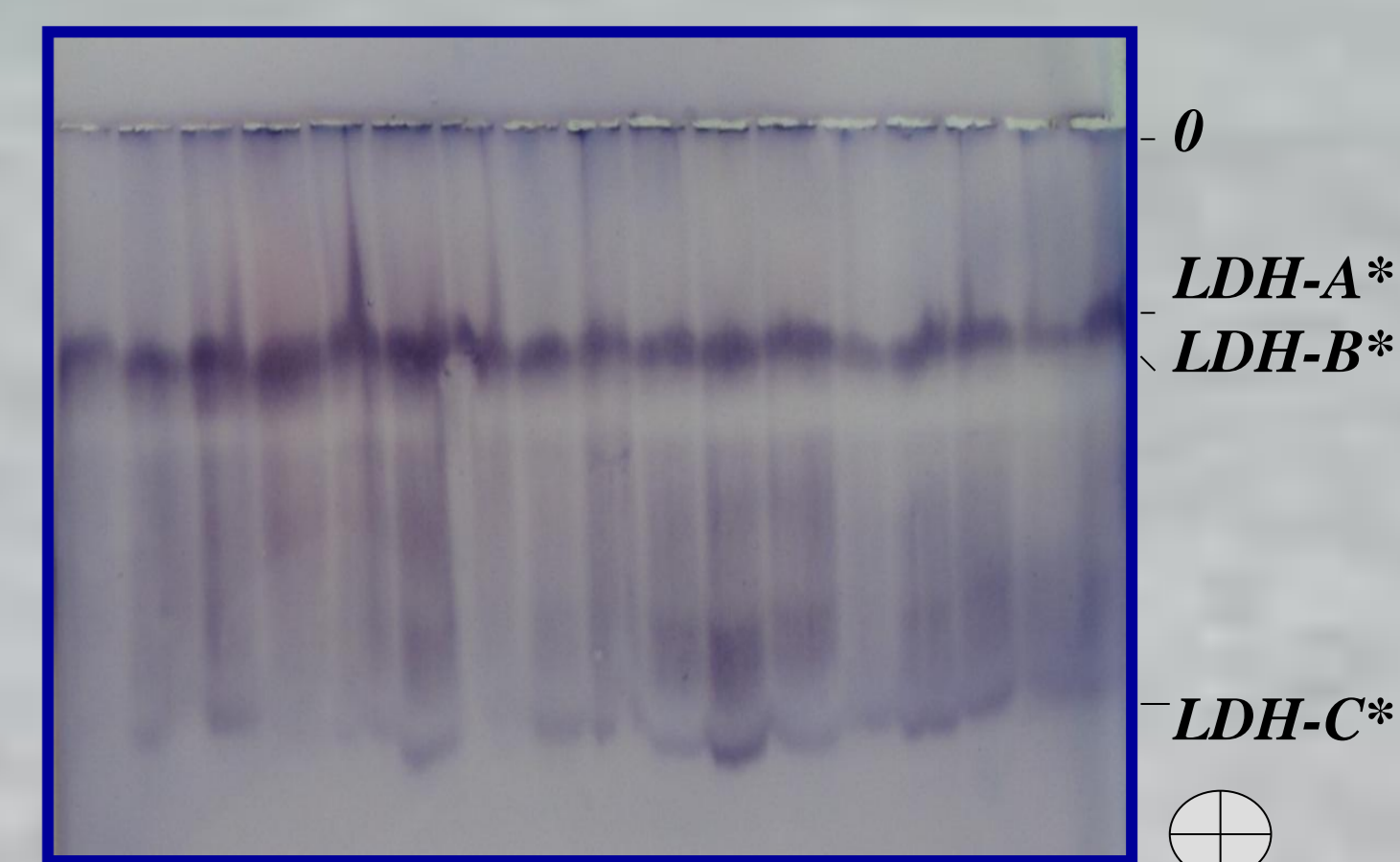


Fig.4. Enzymograms of lactate dehydrogenase (LDH) from muscle tissue of turbot. *LDH-A**, *LDH-B** and *LDH-C**, loci with enzyme activity, 0- origin.

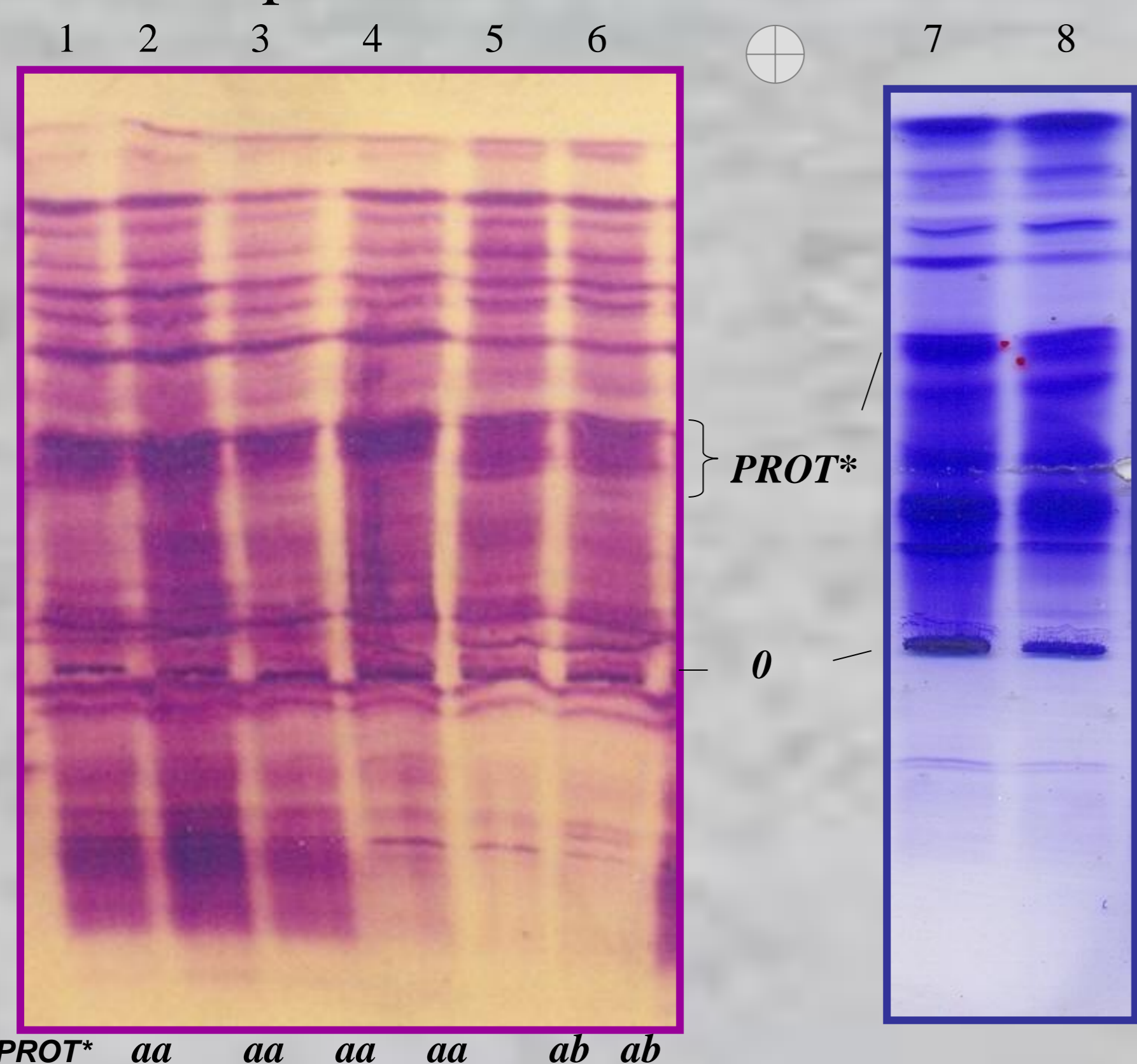


Fig. 6. Isoelectric focusing (IEF) of PROT (muscle tissue) on thin polyacrilamide Ampholine gel with pH gradient 2.5 - 10.

Population of turbot from Sevastopol coast (Ukraine) didn't show differences from other analyzed populations.

The taxonomical position of turbot from Azov Sea also is disputable up to now.

Allozyme comparison between turbot form the Black and Azov Seas showed that they are different on the population level (Fig.6). Polymorphism on general muscle proteins (*PROT**) of turbot from Bulgarian coast was found using IEF (Fig.6) and gene frequencies of *PROT** locus were calculate ($PROT-a^* = 0.682$).

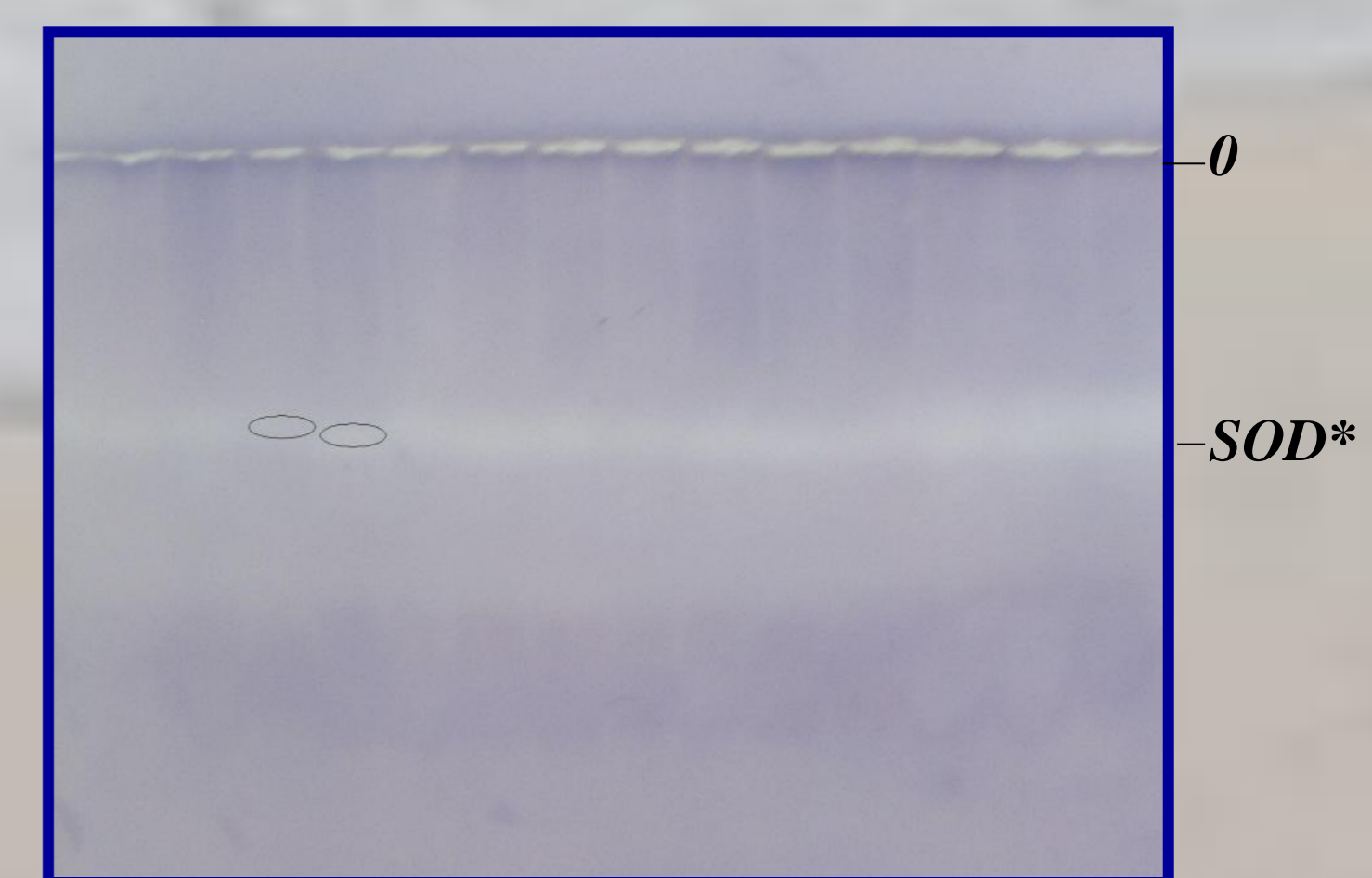


Fig.5. Enzymograms of superoxide dismutase (SOD) from muscle tissue of Black Sea.